Vegetation establishment in the mitigation billabong at the Olentangy River Wetland Research Park in 1998

Virginie Bouchard, Michael Liptak, and William J. Mitsch

School of Natural Resources and Environmental Science Graduate Program
The Ohio State University

Introduction

Vegetation establishment is one of the most important factors in the successful functioning of created wetlands since it affects many potential functions of these systems. The developement of diverse and productive plant communities should be a primary goal of wetland creation effort.

A 3-ha mitigation wetland was constructed in August-December 1996 and planted in May 1997 at the Olentangy River Wetland Research Park (Mitsch et al., 1998). Vegetation was expected to develop into patches of macrophytes mixed with open water in most of the basin. Just a few months after the planting, at the end of the first growing season, little plant cover was observed in the basin but the species diversity was significantly increased (Mitsch et al., 1998). By late summer 1997, 16 of the original 22 plant species introduced in the wetland had survived and 31 new wetland species had colonized the basin (Mitsch et al., 1998). Grazing by large populations of Canada geese had a negative impact on vegetation cover in early summer 1997.

To increase macrophyte development in the wetland, water level was voluntarily reduced to the lowest levels possible in the spring of 1998 by blocking the inflow and pumping out water. This created moist soil conditions conducive to seed germination and growth of young plants. This report gives a description of the plant diversity and vegetation cover that occurred at the end of the second growing season (1998). This vegetation survey will give some indication of the sucess of the adaptative management strategy used during spring 1998.

Methods

Site description

This 2.8-ha (7-acre) mitigation wetland resembles an oxbow wetland and has been called a “billabong”, after the term Australian use for riparian wetlands or oxbows. It is seasonally fed by the Olentangy river when its stage at Clinton Park weir exceeds the water level in the wetland and by groundwater on a seasonal basis. The wetland has deepwater areas (> 15 cm), shallow water (0 to 15 cm) and mudflats. The basins was designed with long slopes (banks of an 8:1 slope) to encourage plant diversity and zonation. In May 1997, plants were planted randomly in the three different locations.

Plant diversity

A vegetation survey of the whole wetland was conducted on foot on early September, 1998. Plant were identified and recorded for four habitats : islands, open water/mudflat, and 1-2ft and 2-3 ft along the slope. For each species, global abundance was estimated in each zone using a four-tiered qualitative classification scheme (not found, present, common or abundant). Indicator status for Region 1 (Northeast) was determined for as many as species possible using the National List (Reed, 1988). Species not found in this National List were indicated as non-listed. Results of this survey are presented in comparison with previous surveys (Mitsch et al., 1998).

Vegetation cover

An aerial photograph taken in early September 1998 was used to delineate the vegetation cover in the basin. The picture was scanned and imported into Photoshop, where the different color patterns were carefully analyzed and mapped. Subsequently, field verifications were made in late September to associate the different patches of color in the photograph to different vegetation communities.

Results and discussion

Species Richness

A total of 116 species were identified in the basin during the ground survey in September 1998 (Table 1). The highest diversity was found on the slopes (zones 1-2 ft, 2-3 ft and islands) of the basin. Using obligate (OBL) and facultative-wetland (FACW and FACW+) as indicators of wetland species, there were a total of 47 wetland species (29 OBL, 8 FACW+ and 10 FACW) found in the basin. Most of these wetland species were preferentially found in the mudflat habitat. Compared to the previous year, we observed a decrease in the number of obligate species and an increase of FACW species (Fig. 1). However, the total number of “wetland species” remained identical. Five obligate species present in 1997 dissapeared during the second growing season: *Juncus acuminatus*, *Leucospora multifida*, *Lycopus asper*, *Rumex verticillatus* and *Symplocarpus foetidus*. On the other hand, two new obligate species appeared in 1998: *Juncus canadensis* (planted in May 1997) and *Lycopus americanus*. Five of the planted obligate species were found neither in 1997 (Mitsch et al., 1998) nor in 1998: *Saururus*

Table 1. Species found in the mitigation wetland at the Olentangy River Wetland Research Park during the late summer survey in 1998

Scientific Name	Common Name	Indicator Status	Open H2O Mudflat	Island	1-2 ft	2-3 ft
*Acorus calamus**	Sweet flag	OBL	P			
*Alisma plantago-aquatica**	Water plantain	OBL	P/C		P/C	
*Asclepias incarnata**	Swamp milkweed	OBL	P	C	C	P
Bidens cernua	Nodding beggars-tick	OBL	P	P	P	
Bidens laevis	Brook sunflower	OBL	P		P	P
*Cephalanthis occidentalis**	Button bush	OBL	P		P	P
Eleocharis obtusa	Blunt spike rush	OBL			P	
Glyceria striata	Fowl Meadow grass	OBL		P	P	
Hypericum boreale	Northern St. John's-wort	OBL			P	
Juncus canadensis	Canada rush	OBL	P			
Leersia oryzoides	Rice cut-grass	OBL	A		P/C	
Lindernia dubia	False pimpernel	OBL	P			
Lycopus americanus	American bugleweed	OBL	P		P/C	P
Lythrum hyssopifolia	Hyssop loosestife	OBL	P			
Lysimachia nummularia	Creeping Jennie	OBL			P	
Lysimachia terrestris	Swamp loosestrife	OBL			P	
Mimulus ringens	Monkey flower	OBL	P		P/C	
Penthorum sedoides	Ditch stonecrop	OBL	P		C	
Polygonum hydropiper	Water pepper	OBL	P			
*Pontederia cordata**	Pickerel weed	OBL	P			
Potamogeton pectinatus	Sago pondweed	OBL	P			
Rorippa islandica	Marsh yellow cress	OBL	P			
*Sagittaria latifolia**	Broad-leaf arrowhead	OBL	P/C			
*Schoenoplectus tabern.**	Soft-stem bulrush	OBL	A		C	
*Scirpus americanus**	three-square rush	OBL	P/C		P	
*Scirpus fluviatilis**	River bulrush	OBL	C		P/C	P
*Sparganium eurycarpum**	Giant burreed	OBL	P/C			
*Spartina pectinata**	Prairie cordgrass	OBL	P		P	
Typha sp.	Cattail	OBL	A		C/A	P
Eupatorium perfoliatum	Common boneset	FACW+	P		C	
Galium trifidum	Small bedstraw	FACW+		P		P
Helenium autumnale	Common sneezeweed	FACW+	P	C	C	
*Juncus effusus**	Soft rush	FACW+	P/C	P	C	
Lobelia cardinalis	Cardinal flower	FACW+			P	
Polygonum lapathifolium	Nodding smartweed	FACW+	P		P	P
Salix nigra	black willow	FACW+	P	C	C/A	
*Scirpus cyperinus**	Woolgrass	FACW+	P			
Aster novi-angliae	New England aster	FACW				P
Bidens comosa	Leafy-bract beggars-tick	FACW	P			
Bidens frondosa	Devil's beggars-tick	FACW	P	P	C	P
Cyperus strigosus	Straw color flatsedge	FACW	P	P	C	P/C
Juncus torreyi	Torrey's rush	FACW	P	P		
Mentha arvensis	Field Mint	FACW	P		P	
Polygonum pensylvanicum	Pennsylvania smartweed	FACW	P	C	C	C
Polygonum persicaria	Lady's Thumb	FACW		P	P	P
Salix alba	white willow	FACW	P	P	P/C	
Salix amygdaloides	peachleaf willow	FACW	P	P		
Verbena hastata	Blue vervain	FACW	P	P	C	P
Acer negundo	Boxelder	FAC+			P	
Physostegia virginiana	obedient plant	FAC+			P/C	P
Acer rubrum	Red Maple	FAC		P	P	P
Aster vimineus	Small white aster	FAC	P	A	C	C
Desmanthis illinoensis	Prairie bundle flower	FAC		P	P	
Eupatorium serotinum	white snake root	FAC			P	
Panicum capillare	Witch grass	FAC		C	P	C
Panicum virgatum	Switchgrass	FAC		P	P	C
Populus deltoides	Cottonwood	FAC	P	C	A	A

Vitis vulpina	Wild grape	FAC		P		P
Xanthium strumarium	Rough cocklebur	FAC			P	P
Hypericum punctatum	Dotted St. John's-wort	FAC-			P	
Phytolacca americana	Pokeweed	FACU+				P
Prunella vulgaris	heal-all	FACU+				P
Ambrosia artemissiifolia	Common ragweed	FACU			P	
Apocynum cannabinum	Indian hemp	FACU		C	P	
Cassia fasciculata	Partridge pea	FACU		P		P
Cirsium arvense	Canada horseweed	FACU		P	C	A
Echinochloa crusgalli	Barnyard grass	FACU	A	P	P/C	
Plantago major	Common plantain	FACU		P		P
Rumex crispus	Curly dock	FACU	P		P	P/C
Silphium perfoliatum	cup-plant	FACU			P	P
Solanum carolinense	Horse nettle	FACU		C	P	P
Solidago altissima	Tall goldenrod	FACU		C		
Sorghum halepense	Johnson grass	FACU				
Trifolium hybridum	Alsike clover	FACU	P			
Trifolium pratense	Red Clover	FACU		P	C	P
Lepidium virginicum	peppergrass	FACU-				P
Melilotus officinalis	Yellow Sweet Clover	FACU-		P		
Oenothera biennis	Evening Primrose	FACU-		C	C	C/A
Rudbeckia hirta	Black -eyed Susan	FACU-			P	
Taraxacum officinale	Common dandelion	FACU-				P/C
Conyza canadensis	Common horseweed	UPL			C	A
Diodia teres	Buttonweed	UPL	P			
Ipomoea purpurea	Common Morning Glory	UPL				C
Oxalis europaea	Upright yellow woodsorrel	UPL			P	P
Abutilon theophrasti	Velvet-leaf	NL			P	
Amaranthus cruentus	Purple amaranth	NL	P		P/C	P
Asclepias tuberosa	Milkweed	NL				P
Bouteloua curtipendula	Side oats grama	NL		P		P
Callitriche terrestris	Water starwort	NL			P	P
Chenopodium capitatum	Lamb's-quarters	NL				P
Cichorium intybus	Chicory	NL				P
Convolvulus sepium	Hedge bindweed	NL		P	P	
Convolvulus spithamaeus	upright bindweed	NL			P	
Daucus carota	Queen Anne's Lace	NL		C	C	A
Desmodium sessilifolium	sessile tick-trefoil	NL		P		P
Epilobium glandulosum	Northern willow-herb	NL			P	
Erigeron canadensis	Horseweed	NL				P/C
Euphorbia corollata	Flowering spurge	NL				P
Gerardia tenuifolia	slender gerardia	NL			P	
Juncus dudleyi	Dudley's rush	NL			P	
Lespedeza intermedia	wandlike bush clover	NL		P	P	
Oxalis stricta	Yellow wood sorrel	NL				P
Physalis virginiana	viginia ground-cherry	NL		P		
Rhus radicans	Poison Ivy	NL		P	P	
Salix exigua (interior)	Sandbar willow	NL	P			
Setaria viridis	Foxtail	NL	P	C	C	
Verbascum thapsus	common mullein	NL				P
Dipsacus sylvestris	teasel	NI			P	P
Crataegus sp.	Hawthorn					P
Eleocharis spp.*	Spike rush		C			
Helianthus sp.	sunflower			P		
Rudbeckia sp.	coneflower			C		C
Solidago sp.	Goldenrod		P	P	C	A
Trifolium sp.	Clover				P	C
Ulmus sp						P
Vernonia sp.				P		

* introduced in May 1997 planting

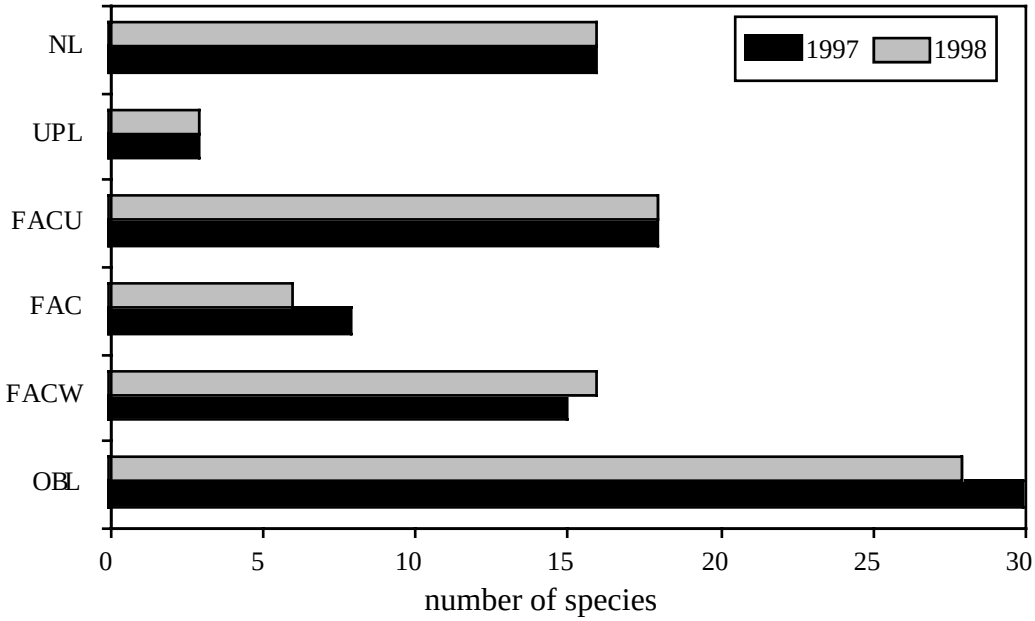

Figure 1. Number of species found in the billabong in 1997 and 1998 according to each wetland plant indication

cernuus, *Iris versicolor*, *Calla palustris*, *Equisetum* sp., and *Zizania aquatica*.

For the other plant categories, the number of species remained approximately similar between 1997 and 1998 (Fig. 1). A significant number of non-listed species appeared in 1998 (Table 1). These species were certainly upland species and were mostly located on the upper part of the slope.

Vegetation Cover

During the second growing season, the plant cover increased rapidly in the basin. Forty-two % of the basin area was non-vegetated mudflat, but the remaining area was vegetated (Table 2). At this early stage of the wetland developement, different plant communities were impossible to distinguished from an aerial picture. However, we identified three main communities according to their species dominance: dominated by obligate species, facultative species, and upland species (Fig. 2 and Table 2). Islands were individually distinguished. After two growing seasons, 29% of the basin was covered by obligates dominated communities.

This rapid increase in the vegetation cover, together with the maintenance of the plant diversity, demonstrated the success of the water level management practiced in spring 1998 and all but assures a healthy wetland plant cover in this newly developing wetland.

Table 2. Surface area (in m^2 and %) of each habitat measured in the billabong in late summer 1998

	m^2	%
Mudflat/open water (non vegetated)	11,934	42.4
Obligate species dominated	8,092	28.7
Facultative species dominated	3,623	12.8
Upland species dominated	4,396	15.7
Islands	122	0.4
Total	28,167	100

References

Reed, P.B. Jr. 1988. National list of plant species that occur in wetlands: Northeast (Region 1). U.S. Fish and Wildlife Service, Washington D.C., Biological Report 88 (26.1).

Mitsch, W.J., Johnson, S., Liptak, M. 1998. Planting and planting sucess of the new mitigation wetland at the Olentangy River Wetland Research Park in 1997. In: W.J. Mitsch and V. Bouchard, The Olentangy River Wetland Research Park at the Ohio State University, Annual Report 1997, The Ohio State University, Columbus, OH, pp. 205-210.

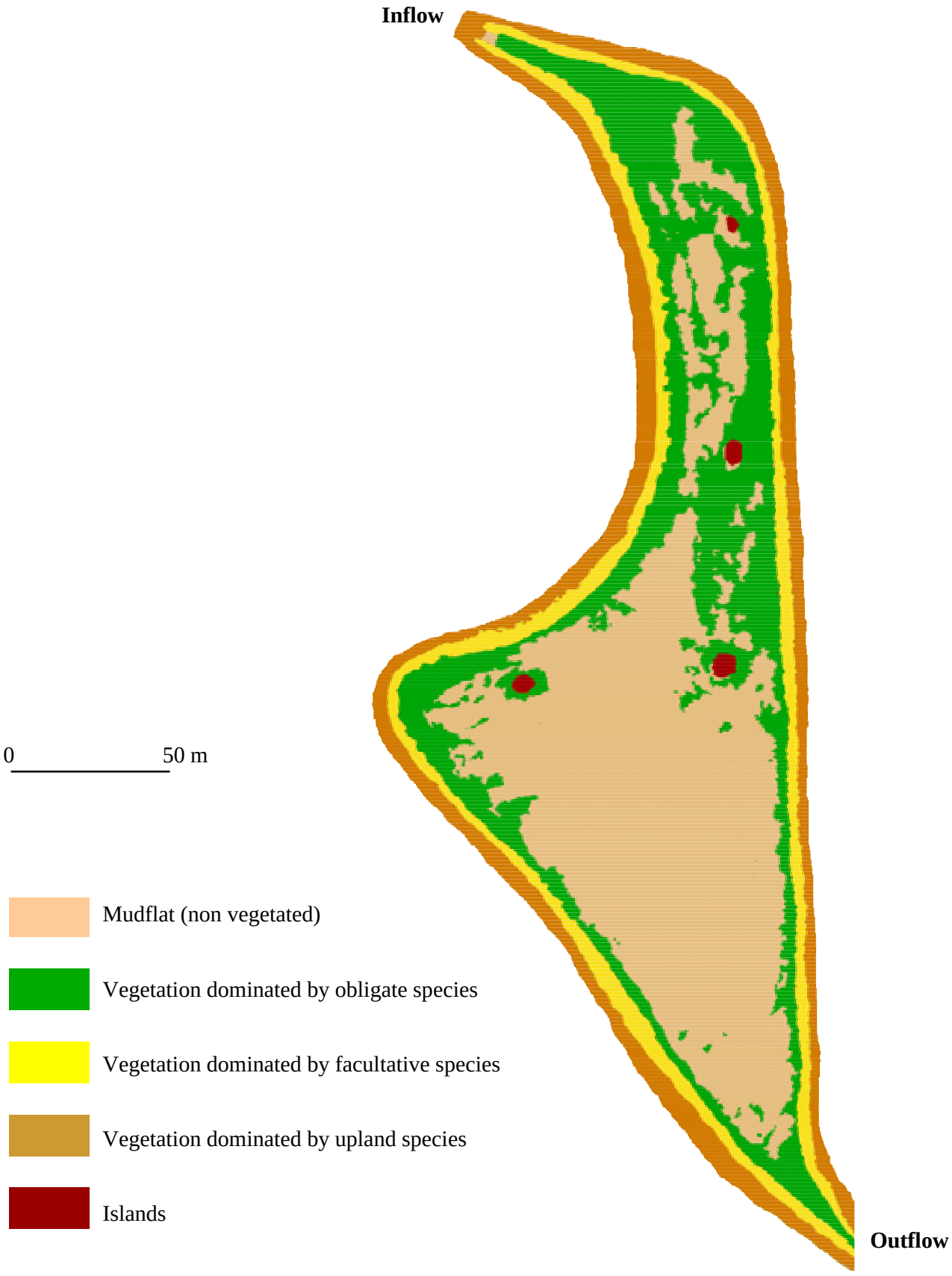

Figure 2. Vegetation map of the billabong in September 1998 showing the principal vegetation types.